

# Meshes in your Radio network?

It may be more likely than you think...

Today i will introduce you to a weird little Czech technology that consumed a year of my life. What is it? You ask.

Well you can get a solid idea by reading their about you site: <https://www.iqrf.org/what-is-iqrf> But in summary, it is an open-source technology for encrypted radio communication in a 255 devices big mesh network. With the name IQRF.

It was made for city wide reliable encrypted communication that uses minimal amounts of power. Its great if you need to create a stable MAN IoT network where you cannot use WiFi or radio towers.

IQRF networks consist of **Nodes** and **Coordinators**, Nodes receive data from sensors they are connected to and also function as paths for the network.

Nodes communicate between each other through DPA (Direct Peripheral Access) packets. These packets use their own DPA protocol (Iain would be proud).

DPA packets follow an inner order of information:

| **NADR**, **PNUM**, **PCMD**, **HWPID**, **DATA** |

Where:

**NADR** is the Nodes address,

**PNUM** is the Peripheral number we want to use \*

**PCMD** is the ID of the \*\*FRC command we want to execute on the Nodes OS

**HWPID** is a unique hardware ID for the selected sensor

**DATA** is a string of bytes we want to send to the Node

DPA packets are encrypted by a three layered AES 128 encryption, with a 16B password set on the Node through a debugger.

For additional security IQRF supports also DATA encryption, so if a DPA packet gets cracked it's data will be encrypted by a separate key.

## **IQRF Node:**

This is a name for any IQRF module that is not serving as a coordinator

The bread and butter of these nodes are so called Custom DPA handler's, this is the code that will run on the Node.

The IQRF IDE provides a few pre-built interoperable Handlers from the get go, but if you feel brave enough you can also write your own in C.

A Node can also be categorized into a **Sensor** Node or a **repeater**, repeaters serve as dedicated paths for the network, as their name suggest they only repeat a request send through them.

## IQRF Coordinator:

This is the *gateway* for the network, we use it to send commands to other nodes using FRC. In production these nodes are usually connected to another micro controller for ease of use. These commercial gateways connect the radio side of the network with the internet one, it's usually done by accepting a MQTT json request and converting them to DPA packets which are then sent to the requested Node.

Most gateways have an API documentation for their json to DPA requests, which you can check out.

Another feature of these gateways are the additions of a **SSH** connection, VPN tunneling and Websockets

## IQRF IDE4:

This is a (n archaic) software made for creating IQRF networks, configuring individual Nodes and a lot more.

In here you can choose the correct DPA Handler, set the bonding and data password, set the communication frequency and channel use the C.A.T.S\*\*\* service etc.

To configure a module you need to connect it to a physical debugger which you then connect to the PC via an USB.

## Creating an IQRF network:

The basics of network creation is **Bonding** and **Discovery**.

You can have up to 255 Nodes bonded to a single coordinator.

Every Node needs to be bonded to a Coordinator that's on the same Frequency, channel and using the same password.

After a Node gets bonded the Coordinator will need to run a Discovery command to count all bonded Nodes and set them into his memory.

The process is quite fast and simple, the biggest problem you can encounter is choosing the wrong DPA Handler for your Node type.

If everything goes correctly we can either use the IQRF IDE to send raw DPA packets with commands to the Node, or if we have a commercial gateway we can use it's interface to communicate.

And that's how you get your own mashed radio network in a matter of minutes. :D

( Fun fact, this tech is so niche that it's only mentioned in two reddit posts)

\* (<https://doc.iqrf.org/DpaTechGuide/> [message parameters])

\*\* FRC is a patented method of sending a command from the Coordinator to all or selected Nodes and receive responses including small data collected by individual Nodes in outstandingly short time  
FRC is much faster (even by orders of magnitude) than polling individual Nodes one by one

The FRC allows to send up to 30 B of user data to all or selected Nodes and collect:

2b from up to 239 Nodes

1B from up to 63 Nodes

2B from up to 31 Nodes

4B from up to 15 Nodes

For more information consult the Chapter FRC from this PDF: [https://static.iqrf.org/User\\_Guide\\_IQRF-OS-406G\\_TR-7xG\\_231005.pdf](https://static.iqrf.org/User_Guide_IQRF-OS-406G_TR-7xG_231005.pdf)

\*\*\* CATS is a Tool to configure IQRF modules when they cannot put into a debugger, for example when they are in a commercial gateway that doesn't open its plastic shell